

AP Statistics Quiz B – Chapter 16 – Key

A fast food restaurant just leased a new freezer and food fryer for three years. The service contract for the freezer offers unlimited repairs for a fee of \$125 a year plus a \$35 service charge for each repair needed. The restaurant's research suggested that during a given year 80% of these freezers need no repairs, 11% needed to be serviced once, 5% twice, 4% three times, and none required more than three repairs.

- Find the expected number of repairs this kind of freezer is expected to need each year. Show your work.

$$E(X) = 0(0.80) + 1(0.11) + 2(0.05) + 3(0.04) = 0.33 \text{ repairs}$$

- Find the standard deviation of the number of repairs each year.

$$\text{Var}(X) = (0 - 0.33)^2(0.80) + (1 - 0.33)^2(0.11) + (2 - 0.33)^2(0.05) + (3 - 0.33)^2(0.04) = 0.561$$

$$\text{Standard deviation} = \sqrt{0.561} = 0.749$$

- What are the mean and standard deviation of the restaurant's annual expense for the service contract?

$$\text{Let } C = \$125 + \$35X; E(C) = \$125 + \$35(0.33) = \$136.55$$

$$\text{Standard deviation}(C) = \$35(0.749) = \$26.22$$

- How many times should the restaurant expect to have to get this freezer repaired over the three-year term of the lease?

$$E(X_1 + X_2 + X_3) = 0.33 + 0.33 + 0.33 = 0.99 \text{ repairs}$$

- What is the standard deviation of the number of repairs that may be required during the three-year term of the lease? On what assumption does your calculation rest? Do you think this assumption is reasonable?

$$\text{Var}(X_1 + X_2 + X_3) = 0.561 + 0.561 + 0.561 = 1.683, \text{ so standard deviation}(C) = 1.297$$

The assumption is that the number of repairs is independent from year to year. This might be incorrect because some freezers might need more service than others.

- The yearly service contract for the food fryer estimates a mean annual cost of \$140 with a standard deviation of \$40. What is the expected value and standard deviation of the total cost for the service contracts for the freezer and the food fryer?

$$E(\text{freezer} + \text{fryer}) = \$136.55 + \$140 = \$276.55$$

$$\text{Var}(\text{freezer} + \text{fryer}) = (\$26.22)^2 + (\$40)^2 = 2287.49, \text{ so standard deviation} = \$47.83$$

- Which service contract should the restaurant expect to cost more each year? How much more? With what standard deviation?

The food fryer's service contract is expected to cost more.

$$E(\text{fryer} - \text{freezer}) = \$140 - \$136.55 = \$3.45 \text{ more}$$

$$\text{Var}(\text{fryer} - \text{freezer}) = \$47.83 \text{ (same as the sum in problem 6)}$$